

Claims

1. A method for enhancing the function of a biological sample comprising contacting the biological sample with a solution comprising pyruvate, inosine, adenine, phosphate and an
5 aziridino compound.
2. A method for enhancing the function of a biological sample comprising contacting the sample with a solution comprising pyruvate, inosine, adenine, and phosphate, then contacting the sample with an effective amount of an aziridino compound.
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3. A method for enhancing the function of a biological sample comprising contacting the sample with an effective amount of an aziridino compound, then contacting the sample with a solution comprising pyruvate, inosine, adenine, and phosphate.
- 15 4. The method of claim 3, wherein the biological sample contains cells and wherein the cell-containing sample is contacted with pyruvate, inosine, adenine and phosphate during a step of cell washing.
5. The method of any of claims 1-3, wherein the pyruvate is present in the solution at a
20 concentration of about 0.4 grams/liter to about 40 grams/liter.
6. The method of any of claims 1-3, wherein the inosine is present in the solution at a concentration of about 1 grams/liter to about 100 grams/liter.
- 25 7. The method of any of claims 1-3, wherein the adenine is present in the solution at a concentration of about 0.027 grams/liter to about 2.7 grams/liter.
8. The method of any of claims 1-3, wherein the phosphate is present as a dibasic phosphate at a concentration of about 0.4 grams/liter to about 40 grams/liter.
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9. The method of any of claims 1-3, wherein the phosphate is present as a monobasic phosphate at a concentration of about 0.16 grams/liter to about 16 grams/liter.

10. The method of any of claims 1-3, wherein the aziridino compound is present at a
5 concentration of about 0.01 mM to about 100 mM.

11. The method of claim 1, wherein the pyruvate is present in the solution at a concentration of about 2.75 grams/liter to about 6.05 grams/liter, the inosine is present in the solution at a concentration of about 6.70 grams/liter to about 14.74 grams/liter, the adenine is
10 present in the solution at a concentration of about 0.17 grams/liter to about 0.37 grams/liter, the phosphate is present as a dibasic phosphate at a concentration of about 2.5 grams/liter to about 5.5 grams/liter and a monobasic phosphate at a concentration of about 1.0 grams/liter to about 2.2 grams/liter and the aziridino compound is present at a concentration of about 2.5 mM to about 55.0 mM.

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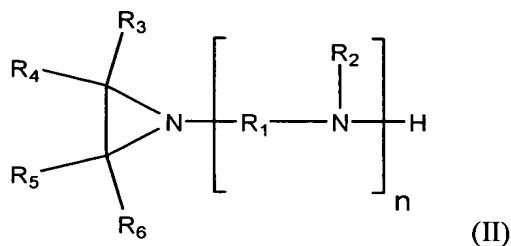
12. The method of claim 11, wherein the pyruvate is present in the solution at a concentration of about 3.85 grams/liter to about 4.95 grams/liter, the inosine is present in the solution at a concentration of about 9.38 grams/liter to about 12.06 grams/liter, the adenine is present in the solution at a concentration of about 0.24 grams/liter to about 0.31 grams/liter, the
20 phosphate is present as a dibasic phosphate at a concentration of about 3.5 grams/liter to about 4.5 grams/liter and a monobasic phosphate at a concentration of about 1.4 grams/liter to about 1.8 grams/liter and the aziridino compound is present at a concentration of about 3.5 mM to about 45 mM.

13. The method of claim 12, wherein pyruvate is present at a concentration of about 4.4 grams/liter, inosine is present at a concentration of about 10.7 grams/liter, adenine is present at a concentration of about 0.27 grams/liter, and phosphate is present as a dibasic phosphate at a concentration of about 4.0 grams/liter and a monobasic phosphate at a concentration of about
25 1.6 grams/liter and the aziridino compound is present at a concentration of about 10.7 mM.

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14. The method of any of claims 1-3, wherein the biological sample comprises one or more red blood cells.

15. The method of any of claims 1-3, wherein the aziridino compound contains a linear alkyl group.

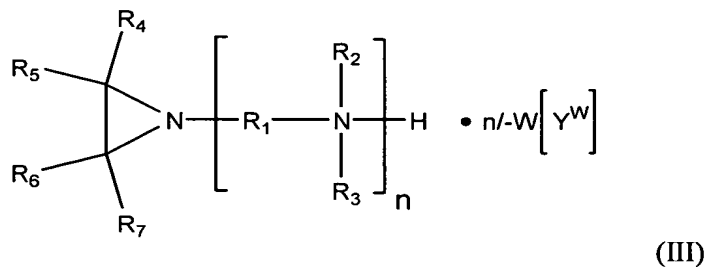


16. The method of claim 15, wherein the aziridino compound has the structure of formula II:

wherein each R_1 is a divalent hydrocarbon moiety containing between two and four carbon atoms, inclusive; each of R_2 , R_3 , R_4 , R_5 , and R_6 is, independently, H or a monovalent hydrocarbon moiety containing between one and four carbon atoms, inclusive; and n is an integer between one and ten, inclusive.

17. The method of claim 16, wherein R_2 , R_3 , R_4 , R_5 , and R_6 are H.

18. The method of claim 15, wherein the aziridino compound has the structure of formula III:



wherein each R₁ is a divalent hydrocarbon moiety containing between two and four carbon atoms, inclusive; each of R₂, R₃, R₄, R₅, R₆, and R₇ is, independently, H or a monovalent hydrocarbon moiety containing between one and four carbon atoms, inclusive; Y is pharmaceutically acceptable counter anion; W is the valency of Y; and n is an integer between one and ten, inclusive.

19. The method of claim 18, wherein R₂, R₃, R₄, R₅, and R₆ are H.

20. The method of claim 15, wherein the aziridino compound is an ethyleneimine oligomer.

21. The method of claim 20 wherein the ethyleneimine oligomer is an ethyleneimine dimer.

22. The method of claim 20, wherein the ethyleneimine oligomer is an ethyleneimine trimer.

23. The method of claim 20, wherein the ethyleneimine oligomer is an ethyleneimine tetramer.

24. The method of claim 14, wherein the pyruvate, inosine, phosphate, adenine and aziridino compound increase the amount of 2,3- DPG levels in the red blood cells relative to the amount of 2,3- DPG in red blood cells not contacted with the pyruvate, inosine, adenine, phosphate and aziridino compound.

25. The method of claim 24, wherein the level of 2,3- DPG is at least about two-fold greater in the red blood cells relative to the amount of 2,3- DPG in red blood cells not contacted with the pyruvate, inosine, adenine, phosphate and aziridino compound.

26. The method of claim 25, wherein the level of 2,3- DPG is at least about five-fold greater in the red blood cells relative to the amount of 2,3- DPG in red blood cells not contacted with the pyruvate, inosine, adenine, phosphate and aziridino compound.

27. The method of claim 14, wherein the pyruvate, inosine, phosphate, adenine and aziridino compound increase the amount of ATP in the red blood cells relative to the amount of ATP in red blood cells not contacted with the pyruvate, inosine, adenine phosphate, and aziridino compound.

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28. The method of claim 27, wherein the level of ATP is at least about one and a half-fold greater in the red blood cells relative to the amount of ATP in red blood cells not contacted with the pyruvate, inosine, adenine, phosphate and aziridino compound.

10 29. The method of claim 28, wherein the level of ATP is at least about two-fold greater in the red blood cells relative to the amount of ATP in red blood cells not contacted with the pyruvate, inosine, adenine, phosphate and aziridino compound.

15 30. The method of claim 24, wherein the pyruvate, inosine, phosphate, adenine and aziridino compound increase the P50 level in the red blood cells relative to the P50 level in red blood cells not contacted with the pyruvate, inosine, phosphate, adenine and aziridino compound.

20 31. The method of claim 30, wherein the level of ATP is at least about one and a quarter-fold greater in the red blood cells relative to the amount of ATP in red blood cells not contacted with the pyruvate, inosine, adenine, phosphate and aziridino compound.

25 32. The method of claim 31, wherein the level of P50 is at least about two-fold greater in the red blood cells relative to the amount of P50 in red blood cells not contacted with the pyruvate, inosine, phosphate, adenine and aziridino compound.

33. A composition comprising an aziridino compound, pyruvate, inosine, adenine and phosphate.

30 34. A kit comprising one or more vials containing an aziridino compound, pyruvate, inosine, adenine and phosphate.

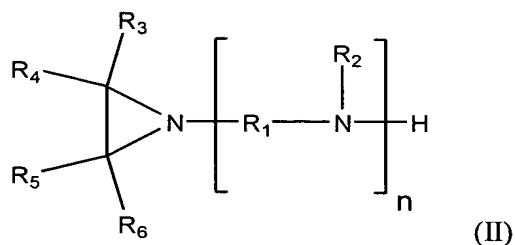
35. A composition comprising an aziridino compound, pyruvate, inosine, adenine, phosphate and a red blood cell washing or storage solution.

5 36. A kit comprising one or more vials containing an aziridino compound, pyruvate, inosine, phosphate, adenine and a red blood cell washing and/or storage solution.

37. The composition of claim 33, wherein the aziridino compound contains a linear alkyl group.

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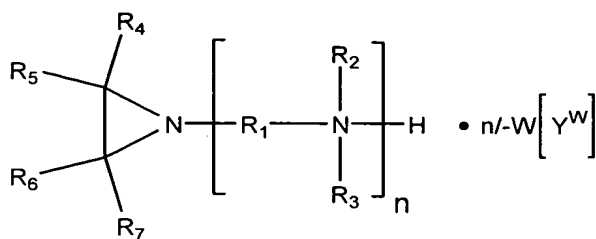
38. The composition of claim 37, wherein the aziridino compound has the structure of formula II:



15 wherein each R_1 is a divalent hydrocarbon moiety containing between two and four carbon atoms, inclusive; each of R_2 , R_3 , R_4 , R_5 , and R_6 is, independently, H or a monovalent hydrocarbon moiety containing between one and four carbon atoms, inclusive; and n is an integer between one and ten, inclusive.

20 39. The composition of claim 38, wherein R_2 , R_3 , R_4 , R_5 , and R_6 are H.

40. The composition of claim 37, wherein the aziridino compound has the structure of formula III:



(III)

wherein each R₁ is a divalent hydrocarbon moiety containing between two and four carbon atoms, inclusive; each of R₂, R₃, R₄, R₅, R₆, and R₇ is, independently, H or a monovalent hydrocarbon moiety containing between one and four carbon atoms, inclusive; Y is pharmaceutically acceptable counter anion; W is the valency of Y; and n is an integer between one and ten, inclusive.

41. The composition of claim 40, wherein R₂, R₃, R₄, R₅, and R₆ are H.

42. The composition of claim 37, wherein the aziridino compound is an ethyleneimine oligomer.

43. The composition of claim 42, wherein the ethyleneimine oligomer is an ethyleneimine dimer.

44. The composition of claim 42, wherein the ethyleneimine oligomer is an ethyleneimine trimer.

45. The composition of claim 42, wherein the ethyleneimine oligomer is an ethyleneimine tetramer.

46. A method for enhancing the function of a red blood cell population, comprising contacting the red blood cell population with a solution comprising an aziridino compound, pyruvate, inosine, adenine and phosphate.

47. A method for enhancing the function of a red blood cell population, comprising contacting the red blood cell population with a solution comprising an ethyleneimine oligomer compound, pyruvate, inosine, adenine and phosphate.
- 5 48. The method of claim 46 or claim 47, wherein the red blood cell population is contacted with pyruvate, inosine, adenine and phosphate during a step of cell washing.
49. A method for transfusing blood into a subject, comprising introducing the biological sample treated by the method of claim 1 into the patient.
- 10 50. The method of claim 49, wherein the biological sample comprises red blood cells.
51. The method of claim 49, wherein the transfusion into the subject is heterologous.
- 15 52. A method for selectively inactivating a pathogen in a biological sample, comprising treating the biological sample with a solution comprising an effective amount of an aziridino compound, pyruvate, inosine, adenine and phosphate.
53. A method for selectively inactivating a pathogen in a blood cell population, comprising
20 contacting the blood cell population with a solution comprising pyruvate, inosine, adenine and phosphate; and treating the contacted blood cell population with a solution comprising an effective amount of an aziridino compound.
54. A method for selectively inactivating a pathogen in a blood cell population, comprising
25 contacting the blood cell population with a solution comprising an effective amount of an aziridino compound; and treating the contacted blood cell population with a solution comprising pyruvate, inosine, adenine and phosphate.
55. A method for selectively inactivating a pathogen in a blood cell population, comprising
30 contacting the blood cell population with a solution comprising pyruvate, inosine, adenine, phosphate and an effective amount of an aziridino compound.

56. A blood-collecting device comprising a container for receiving blood or a blood fraction, the container comprising an aziridino compound, pyruvate, inosine, phosphate, and adenine in an amount effective to inactivate pathogens in the blood or fraction thereof received
5 into the container.
57. A blood-collecting device comprising a container for receiving blood or a blood fraction, the container comprising an aziridino compound, pyruvate, inosine, phosphate, and adenine in an amount effective to enhance the function of the blood or fraction thereof received
10 into the container.
58. The blood-collecting device of claim 57, wherein the function of red blood cells is enhanced.